

Comparison of Analgesic Efficacy Between the Adjuvants Dexamethasone and Clonidine on Supraclavicular Brachial Plexus Block: A Randomised Study

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Received: February 2020

Accepted: February 2020

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ABSTRACT

Background: Adjunct to local anesthetics enhances pain relief by different mechanisms. So the aim of our study was to evaluate the analgesic efficacy of Clonidine and Dexamethasone with local anesthetic in brachial plexus block. **Methods:** 60 patients aged 20-40 years of either sex (ASA-1 and ASA-2) undergoing upper limb surgeries were included in this prospective, double-blind randomized comparative study. Patients were divided into two (n = 30) groups. Group I patients were given 15 ml of Bupivacaine with 15 ml of 2% Xylocaine with Adrenaline and Clonidine 1 μ g/kg as adjunct and Group II patients were given 15 ml of Bupivacaine with 15 ml of 2% Xylocaine with Adrenaline and Dexamethasone 4 mg as adjunct. Statistical analysis used: Both groups were compared by using Student's t-test. **Results:** No statistically significant difference noted between the two groups in demographic variables. The mean time required for onset of sensory block in Group I is 10.07 minutes and in Group II is 8.51 min, onset of motor block Group I is 12.45 minutes and in Group II is 11.21 min. The average duration of sensory block in Group I is 813.00 min, and in Group II with 845.40 min. The average duration of Motor block in Group I is 844.83 min, and in Group II with 854.47 min. **Conclusion:** Thus, in our study the addition of Dexamethasone to local anesthetics in brachial plexus block shows a greater duration of analgesia than Clonidine.

Keywords: Analgesia, Clonidine, Dexamethasone.

INTRODUCTION

Post-operative pain increases the possibility of post-surgical complications,^[1] raises the cost of medical care and importantly interferes with recovery and return to normal activities of daily living. The World Health Organization and International Association for the Study of Pain have recognized pain relief as a human right.^[2] Adequate postoperative pain relief will reduce the incidence of pulmonary complications, allowing the patient to take deep breath and cough effectively. It will also allow early ambulation thus preventing deep vein thrombosis. Any method of postoperative analgesia must meet three basic criteria: it must be effective, safe and feasible. Brachial plexus block (John M. Pester; Matthew Varacallo) is very popular for upper limb (Below shoulder) surgeries and it avoids the untoward side effects of General anesthesia and upper airway instrumentation.^[3] The addition of

adjuvant like Clonidine and Dexamethasone with the routine local anesthetics increases the analgesic efficacy of brachial plexus block. Steroids having anti-inflammatory (by inhibiting Phospholipase A2) and analgesic property by blocking the transmission of nociceptive C fibres.^[4,5]

MATERIALS AND METHODS

A total number of 60 patients of ASA grade I and II of either sex belonging to the age group of 20-40 years and scheduled to undergo infra shoulder surgeries were included in the study after obtaining written and informed consent from patient as well as patient's relatives and Ethical committee clearance from Medical college. Intra-dermal Bupivacaine and Xylocaine sensitivity were carried out. The supraclavicular approach preferred for brachial plexus block for both the groups.

Group-I (30 nos. cases): Patient injected with 15 ml of Bupivacaine with 15 ml of 2% Xylocaine with Adrenaline and Clonidine 1 μ g/kg.

Group-II (30 nos. cases): Patient injected with 15 ml of Bupivacaine with 15 ml of 2% Xylocaine with Adrenaline and Dexamethasone 4mg.

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Before the arrival of the patient, the study subjects were randomized by using block randomization using sealed concealed envelopes into two groups namely Group I and Group II each consisting of 30 patients. In operation theatre, I.V. line was established with 18 G IV cannula. Pulse rate, NIBP, respiratory rate, O₂ saturation (by pulse oxymetry) and ECG status (by cardiac monitor) recorded 15 minutes before Supraclavicular brachial plexus block and taken as preoperative baseline values based on which intra and postoperative complications were diagnosed.

The detailed procedure explained to the patient prior to the procedure for the elicitation of paresthesia after needle insertion. All the patients under study were given Brachial Plexus Block by a supraclavicular approach.

PR, BP, RR, O₂ saturation were checked immediately and thereafter. SBP, DBP, MAP and HR measured and noted at 5 min, 10 min, 15 min, 30 min, 45 min, 60 min, 75 min, 90 min, 105 min and 120 min intervals.

Intra-operative monitoring:

The onset of sensory block, i.e., the time from injection to onset of analgesia in each of the major peripheral nerve distribution (ulnar, radial, median and musculocutaneous) was assessed by pinprick using the blunt end of a 27-G needle at 0, 2, 5, 10, 15, 20 and 30 min. Sensory block was graded according to the following scale: 0 = no block (normal sensation), 1 = partial block (decreased sensation) and 2 = complete block (no sensation).

The onset of motor block, i.e. the time from injection to the inability of the patient to move his/her fingers or raise hand. Motor block was measured at 0, 10, 20, 30 and 40 min by assessing the following motor functions: Flexion at the elbow (musculocutaneous nerve), extension of the elbow and the wrist (radial nerve), opposition of the thumb and index finger (median nerve), and opposition of the thumb and small finger (ulnar nerve). Motor block was graded according to the following scale: 0 = no block (full muscle activity), 1 = partial block (decreased muscle activity) and 2 = complete block (no muscle activity).

Post-operative monitoring:

Post-operative follow-up was carried out in the recovery and post-operative ward. All the above-mentioned parameters (PR, BP, RR, O₂ saturation) were monitored.

The duration of sensory block was noted according to 0-10 Visual Analog Score (VAS) [6] for pain at every 1 h until the first 10 h and thereafter 2 hourly until next 24 h. When the patients began to experience pain (VAS = 4), it was considered that analgesic action of the drugs was terminated, and rescue analgesic (Injection Diclofenac 1-1.5 mg/kg IM) was given.

Duration of motor block postoperatively was assessed every hourly by asking the patients to move their fingers and to see whether the elbow flexion could be done against gravity or not. This time was recorded and taken as the cessation of the motor block effect. The above assessments were carried out by the principal investigator who was blinded to the drugs administered in the brachial plexus block. Possible complications of brachial plexus block such as pneumothorax, hematoma, signs and symptoms for local anesthetic toxicity were looked for and noted, if any.

Statistics

There were no dropouts. IBM SPSS v.17 software was used for data analysis. Data were summarized as mean with standard deviation. The findings were compared using "Student's t-test".^[7]

RESULTS

As per demographic profile, the average age was 28.50 years in Group I and 29.27 years in Group II, and the average weight was 59.93 kg in Group I and 58.77 kg in Group II. Both groups were comparable as per age and weight.

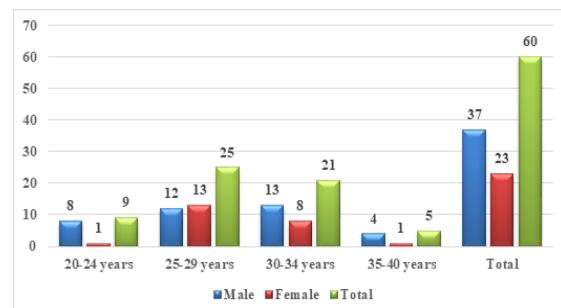


Figure 1: Distribution of Age & Sex

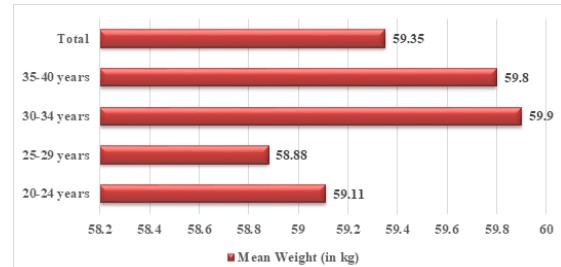


Figure 2: Mean Weight according to Age Category

Mean duration of the onset of sensory blockade with Clonidine was 10.08 ± 0.91 minutes. Mean duration of the onset of sensory blockade with Dexamethasone was 8.51 ± 0.68 minutes. The difference in the mean duration of the onset of sensory blockade in both the groups was statistically significant ($p < 0.001$).

Mean duration of the onset of motor blockade with Clonidine was 12.45 ± 2.52 minutes. Mean duration of the onset of motor blockade with Dexamethasone

was 11.22 ± 2.12 minutes. The difference in the mean duration of the onset of motor blockage in both the groups was statistically significant ($p=0.044$).

Mean duration of the sensory blockade with Clonidine was 813.00 ± 100.14 minutes. Mean duration of the sensory blockade with Dexamethasone was 845.40 ± 68.42 minutes. The difference in the mean duration of the sensory

blockade in both the groups was statistically not significant ($p=0.149$).

Mean duration of the motor blockade with Clonidine was 844.83 ± 74.86 minutes. Mean duration of the motor blockade with Dexamethasone was 854.47 ± 79.30 minutes. The difference in the mean duration of the motor blockade in both the groups was statistically not significant ($p=0.630$).

Table 1: Comparison of SBP, DBP, MAP and Heart Rate of both Group I & II

	Group-I				Group-II			
	SBP (mmHg)	DBP (mmHg)	MAP (mmHg)	HR Per Minute	SBP (mmHg)	DBP (mmHg)	MAP (mmHg)	HR Per Minute
Baseline	122	78	92.6	80	126	78	94.0	82
At 5 min.	118	68	84.6	78	120	74	89.3	76
At 10 min.	128	76	93.3	82	118	74	88.6	78
At 15 min.	116	80	92.0	76	118	76	90.0	72
At 30 min.	118	78	91.3	78	124	80	94.6	80
At 45 min.	126	78	94.0	72	128	78	94.6	74
At 60 min.	120	80	93.3	76	120	80	93.3	74
At 75 min.	118	72	87.3	78	128	74	92.0	78
At 90 min.	124	78	93.3	80	116	78	90.6	72
At 105 min.	128	80	96.0	74	112	76	88.0	76
At 120 min.	120	76	90.6	78	122	78	92.6	80

Table-2: Onset of action and Duration of block

Group	Onset of action (in min.) (m±SD)		Duration of block (in min.) (m±SD)	
	Sensory	Motor	Sensory block	Motor block
I	10.077±0.9050	12.453±2.5226	813.00±100.143	844.83±74.858
II	8.510±0.6804	11.217±2.1202	845.40±68.423	854.47±79.302

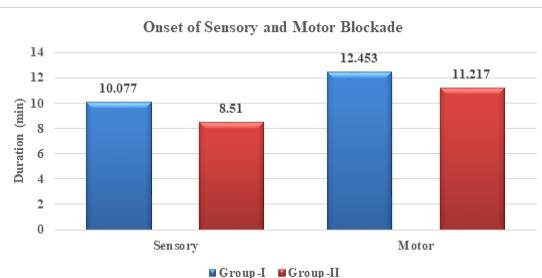


Figure 3: Onset of Sensory and Motor Blockade

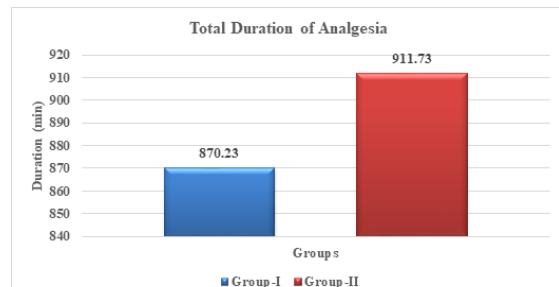


Figure 5: Total Duration of Analgesia

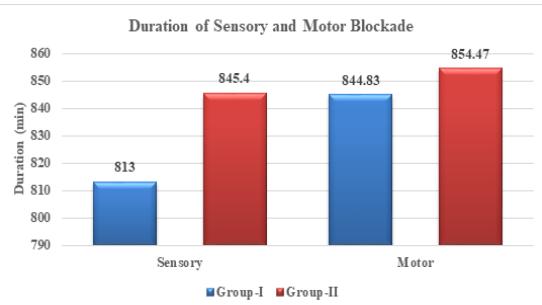


Figure 4: Duration of Sensory and Motor Blockade

Table 3: Total duration of analgesia

Group	Average duration (mean± SD) (in min)
I	870.23 ±10.699
II	911.73 ± 12.348

The total duration of analgesia is 870.23 minutes for Group I and 911.73 minutes for Group II. The p-value is highly significant ($p<0.001$).

Complications

On following 7 days post-operatively, none of the patients in either group developed any neurological complication.^[8]

Table 4: Complication of Brachial plexus Block

Complication	Group-I	Group-II
Nausea & Vomiting	Nil	Nil
Local Anesthetic Toxicity	Nil	Nil
Hypersensitivity	Nil	Nil
Hematoma	Nil	Nil
Pneumothorax	Nil	Nil
Post block neuropathy	Nil	Nil
Any vascular puncture	Nil	Nil

DISCUSSION

Regional anesthesia is a boon in the present era of patient care because of its simplicity of the technique, preservation of consciousness, avoidance

of airway instrumentation and rapid recovery with adequate postoperative analgesia.^[9] Regional anesthesia like Supraclavicular Brachial Plexus Block approach for the upper extremity surgery is popular now days mainly because of the fact that the regional anesthesia techniques can be utilized for analgesia not only during the operative period but during the postoperative period as well and avoids complications of general anesthesia.^[10] It is a simple, safe and effective technique of anesthesia having distinct advantages over general and intravenous regional anesthesia and blocking the autonomic, sensory and motor fibers supplying the upper extremity. To enhance the analgesic effect for the post-operative period, various methods have been tried with the aim of prolonging the local anesthetic action, like continuous infusion of local anesthetics via indwelling catheters and use of different adjuvants in local anesthetics.^[11] In our study, clonidine and dexamethasone were used as adjuvants to local anesthetics. This study was a randomized, comparative study.

Clonidine is an α_2 agonist and its antinociception action might be due to blocking of transmission of pain information by activating presynaptic and postsynaptic α_2 -adrenoceptors in the spinal cord, which inhibit substance P release (Kuraishi Y, 1985),^[12] and dorsal horn neuron firing respectively. Fielding S et.al.^[13] described the Antinociceptive action of clonidine. According to Meire Nakamura et.al.^[14] The Peripheral analgesic action of clonidine is mediated by the release of endogenous enkephalin like substances. (Antinociception was due to involvement of interneurons causing primary afferent depolarization of cutaneous sensory fibers resulting in attenuation of pain as described by Zemlan).

Dexamethasone is a glucocorticoid (Steroid group) and as we know Steroids have nerve block prolonging effects.^[15] They block the nociceptive impulse transmission along the myelinated C fibres. Steroids are very potent anti-inflammatory and immunosuppressive agents. Perineural injection of steroids is reported to influence postoperative analgesia.

As per our clinical study, 60 patients (ASA I and ASA II) were selected (patients undergoing upper limb surgeries) and were divided into Group I and Group II.

Group I (30 nos. cases): Patient injected with 15 ml of Bupivacaine with 15 ml of 2% Xylocaine with Adrenaline and Clonidine 1 μ g/kg.

Group II (30 nos. cases): Patient injected with 15 ml of Bupivacaine with 15 ml of 2% Xylocaine with Adrenaline and Dexamethasone 4mg.

The assessment of onset and duration of block was carried out by the principal investigator who was blinded to the drugs administered in the block. In this study, the mean age of patients in Group-I was 28.50 ± 3.298 years. The mean age of patients in

Group-II was 29.27 ± 4.185 years. ($p = 0.434$). The mean weight of the patients in Group-I and Group-II was 59.93 ± 3.629 kg and 58.77 ± 4.485 kg, respectively ($p = 0.273$).

Mean onset of sensory block in Group-I is 10.08 ± 0.91 minutes. Mean onset of sensory block in Group-II is 8.51 ± 0.68 minutes ($p < 0.001$) [Table 2]. Mean onset of motor block in Group-I is 12.45 ± 2.52 minutes. Mean onset of motor block in Group-II is 11.22 ± 2.12 minutes ($p = 0.044$) [Table 2]. Both these data were statistically significant as $p < 0.05$. This study showed that there was no significant difference in the onset time of sensory and motor block in Group-II compared with Group-I. Mean duration of sensory block in Group-I is 813.00 ± 100.14 minutes. Mean duration of sensory block in Group-II is 845.40 ± 68.42 minutes ($p = 0.149$) [Table 2]. Mean duration of motor block in Group-I is 844.83 ± 74.86 minutes. Mean duration of motor block in Group-II is 854.47 ± 79.30 minutes ($p = 0.630$) [Table 2]. Both the data were statistically insignificant.

Earlier studies have shown that dexamethasone effectively and significantly prolongs the duration of analgesia when used as adjuvants with local anesthetics. Estebe IP et al,^[16] studied the effect of dexamethasone on motor brachial plexus block with bupivacaine and with bupivacaine-loaded microspheres in a sheep model and found that the incorporation of dexamethasone in bupivacaine-loaded microspheres dramatically increases the duration of action of sensory and motor block and the effect of dexamethasone is due to its local action and not a systemic one.

Similar to our study by Stan T et al,^[17] found that the duration of sensory analgesia (23 hours in study group versus 16 hours in control group, $P < 0.01$) and motor block (19 hours in study group versus 13 hours in control group, $p < 0.001$) were significantly longer in the steroid group.

Another study done by Bernard et al,^[18] as similar as ours that they evaluated the effects of adding clonidine to lignocaine for axillary brachial plexus block. They found that the addition of clonidine hastened the onset of the both sensory and motor block and improved the efficacy of surgical anesthesia. Clonidine having the property of local vasoconstriction resulting in delayed absorption of local anesthetic and prolong the block.^[19]

Studies done by Shrestha et al^[20], Cummings et al,^[21] Pathak et al,^[22] and Choi et al.^[23] shows that the duration of sensory and motor block increases by using the adjuvants with local anesthetics as proved by our study.

CONCLUSION

To conclude, adjuvants like clonidine, Dexamethasone with brachial plexus block are safe and boon in anesthetic practice. The advanced new

technology and addition of adjuvants will definitely avoid the complication of general anesthesia for upper limb surgeries. Clonidine and Dexamethasone as adjuvant hastens the onset of sensory block and motor blockade. It prolongs the duration of sensory and motor blockade as well as the total duration of analgesia. As per our study, the adjuvant Dexamethasone is better than that of Clonidine in regards to the duration of blockade (Sensory and Motor) in Brachial plexus block.

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How to cite this article: Behera CS, Nayak GK, Panda A. Comparison of Analgesic Efficacy Between the Adjuvants Dexamethasone and Clonidine on Supraclavicular Brachial Plexus Block: A Randomised Study. *Ann. Int. Med. Den. Res.* 2020; 6(2):AN26-AN30.

Source of Support: Nil, **Conflict of Interest:** None declared